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BRIEF COMMUNICATION

ILIAL SHAFT CURVATURE: A NOVEL OSTEOLOGICAL FEATURE DISTINGUISHING TWO CLOSELY RELATED SPECIES OF AUSTRALIAN FROGS

The status of the Australian frog *Limnodynastes spenceri* Parker (1940)[1], as a species distinct from *L. ornatus* (Gray, 1842)[2], has been the subject of controversy. In the course of the study of fossil material it was noted that there was a distinct curvature of the shaft of the ilium of *L. ornatus*, whereas the ilium of *L. spenceri* appeared straight[3]. The present study was undertaken as a component of studies of fossil material seeking means of distinguishing species by features of the ilium.

Limnodynastes ornatus was described from material collected at Port Essington in the Northern Territory. The species is now recognised to occupy much of the northern and eastern seaboard of Australia[4].

Initial concepts of what constituted *L. ornatus* involved a species that ranged broadly over the northern half of the continent. Parker[1] described *L. spenceri* from Alice Springs. This latter species is currently used to accommodate the central Australian individuals formerly referred to as *L. ornatus*, but more extensive interdigital webbing of the feet in *L. spenceri* is one of the few distinguishing morphological features.

Not all authors have supported the recognition of more than one species[6,7]. More recently the populations have been considered distinct, being distinguished principally by features other than external morphology[3,4,8,9]. A phylogenetic analysis[10] examined the evolutionary relationships within the genus *Limnodynastes* but data were not sensitive enough to resolve the species status of *L. ornatus* and *L. spenceri*.

The ilium has been used to distinguish and identify fossil species of Australian frogs[11]. This bone is the largest component of the anuran pelvis and varies in length of shaft, posterior shape and the presence and absence of various protuberances[12]. The length of the ilial shaft is an adaptation to jumping and symmetrical propulsion in swimming and it is considered that longer ilial shafts are generally associated with species displaying saltatorial habits, whereas shorter shafts are characteristic of terrestrial or fossorial species that tend to walk rather than jump[12]. The posterior of the ilium provides the point of attachment for muscles responsible for propulsion[13]. The size and shape reflect the different habits of species. The posterior of the ilium is more likely to be larger in species that require powerful leg muscles (i.e. those that are significantly adapted to jumping, swimming or burrowing (M.J.T. unpub.)).

The length of the ilium has been shown to be linearly related to snout-vent (S-V) length in *Cyclorana australis* (Gray)[14]. This relationship was examined for *L. spenceri* and *L. ornatus* to determine if there was a similar relationship. Specimens of the two species were obtained from collections at the Department of Environmental Biology, University of Adelaide. Further specimens of *L. spenceri* were provided by the South Australian Museum.

The snout-vent length (S-V) of each specimen was measured to the nearest 0.1 mm using Helios dial callipers before the specimens were dissected to remove the ilium. Small ilia (which are prone to distortion due to dehydration (M.J.T. unpub.)) were preserved in 65% ethanol. The length of the ilium was measured from the tip of the dorsal acetabular expansion to the end of the ilial shaft (AB in Fig. 1). Snout-vent length for each specimen was plotted against ilium length (IL) for each species. Each ilium was then aligned horizontally in a lateral plane under a dissecting microscope and the outline drawn using a camera lucida. The curvature of the ilial shaft was measured indirectly from these drawings as follows (refer to Fig. 1). The length of the ilial shaft, CB, was measured from the superior extremity of the dorsal acetabular prominence to the distal end of the ilial shaft. The midpoint, D, of this line was found. A line perpendicular to CB from D was drawn to intersect with the dorsal surface of the ilial shaft, E. The curvature of the ilial shaft was expressed as the angle formed by CEB. The smaller the angle formed by CEB the greater the curvature of the ilial shaft (compare (a) and (b) in Fig 2).

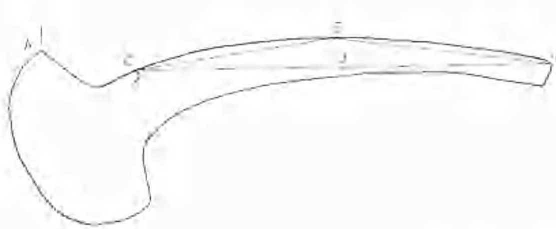

Fig. 1. Diagrammatic representation of lateral surface of a frog pelvis showing reference points for measurements.

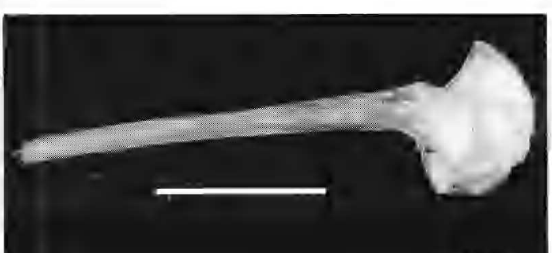

Fig. 2. Lateral views of pelvises of *Limnodynastes spenceri* (top) and *L. ornatus* (bottom). Note the difference in the curvature of the ilial shaft. Scale bars = 5 mm.

The normality of ilial shaft curvature data was confirmed before differences between the two data sets were tested using a two sample t-Test, assuming equal variance.

Strong relationships between S-V length and ilial shaft length were found with R^2 values of 0.96 for both *L. ornatus* and *L. spenceri* (Figs 3, 4). Comparison of the linear equations of the trend lines showed that *L. ornatus* and *L. spenceri* demonstrated similar S-V v. ilial length relationships. The limited number of *L. spenceri* specimens available constrained the data in the S-V range of 21-30 mm.

The curvature of the ilial shaft for *L. ornatus* was found to be significantly greater than that of *L. spenceri* at a confidence level of 99%. The mean angle for *L. ornatus* was 170.4°, whereas that for *L. spenceri* was 177.6°, a mean difference of 7.2°.

Limnodynastes ornatus is known from the Cainozoic of Queensland[3] but it is not known whether *L. spenceri* coexisted or had in fact diverged from it before this era. The slight but significant difference in the shape of the ilial shaft will provide a simple means of distinguishing these species if suitable deposits are found in Central Australia.

We are grateful to M. Hutchinson, South Australian Museum, who provided several specimens of *Limnodynastes spenceri* for use in this study, L. Russell for Figure 2 and to the referees for their constructive criticism.

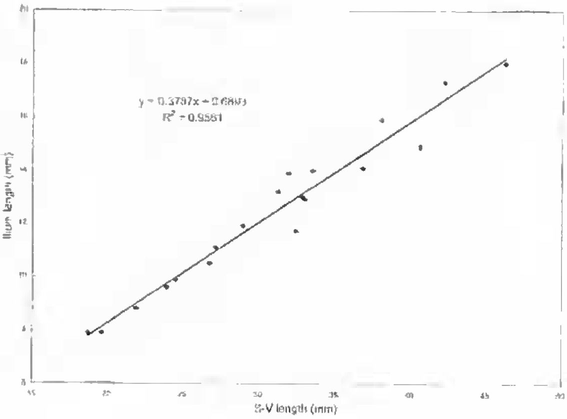

Fig. 3. Regression line of ilial length plotted against S-V length of *Limnodynastes ornatus*.

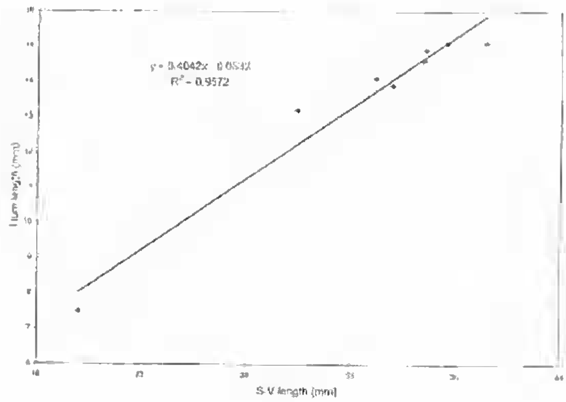

Fig. 4. Regression line of ilial length plotted against S-V length of *Limnodynastes spenceri*

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